(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 677 887 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **94201013.3**

(51) Int. Cl.[6]: **H01Q 7/06**

(22) Date of filing: **13.04.94**

(43) Date of publication of application:
18.10.95 Bulletin 95/42

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IE IT LI LU MC NL PT SE

(71) Applicant: **TEXAS INSTRUMENTS INCORPORATED**
13500 North Central Expressway
Dallas
Texas 75265 (US)

(72) Inventor: **Orthmann, Kurt**
Lothstrasse 22
D-80335 München (DE)

Inventor: **Hagl, Andreas**
Uhdestrasse 23
D-85221 Dachau (DE)
Inventor: **Borsanyi, Thomas**
Pfaffenhofenerstrasse 15
D-84072 Au (DE)
Inventor: **D'Hondt, Loek**
De Notekraker 2,
NL-7609 JK Almelo (NL)

(74) Representative: **de Bruijn, Leendert C. et al**
Nederlandsch Octrooibureau
P.O. Box 29720
NL-2502 LS Den Haag (NL)

(54) Built-in chip transponder with antenna circuit.

(57) An antenna circuit to be used in conjunction with a chip transponder (2) to be built-in in a thick-walled surface (1) which may be of metal. The antenna circuit is insertable into a depression in the surface destined for the chip transponder and serves both for the reception and emission respectively of interrogative signals for - and response signals from - the transponder. The antenna circuit is formed by potcore means which has a radiation field extending in a direction away from the surface, and which is provided in the depression, except at the surface side, with a surrounding shield of a non-ferro metal. The shield consists of an open shielding jacket (5) with bottom and wall. The potcore means comprises at least an open half potcore of ferrite (3) having a winding package (4), and the wall of the shielding jacket, arranged around the potcore, extends to the surface side. The potcore either extends to the surface side and is open at said side, or extends to just under the surface side, and at said side is covered with a cover plate of ferrite having at least a center hole. Said plate is aligned with the edge of the shielding jacket and the surface side. The hole in the cover plate may be implemented as a slot extending on both sides of the center.

Fig-1a

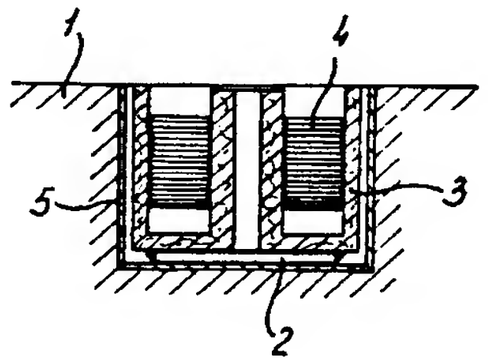
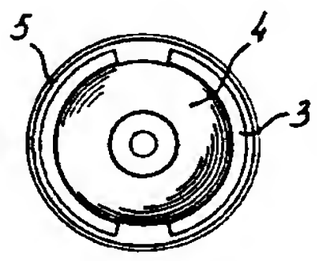


Fig-1b



EP 0 677 887 A1

Field of the invention.

The invention relates to an antenna circuit to be used in conjunction with a chip transponder to be built-in in a thick-walled surface, which antenna circuit is insertable into a depression in the surface destined for the chip transponder en serves both for the reception and emission respectively of interrogative signals for - and response signals from - the transponder, and in which the antenna circuit is formed by potcore means which have a radiation field extending in a direction away from the surface. Such an antenna circuit is known in practice.

Background of the invention.

It is known in this practice to attach such a transponder chip and associated antenna circuit to an object that is to be identified. The said antenna circuit or antenna element is often of a high μ material. The chip transponder and associated antenna circuit, which are then both built-in in a thick-walled surface, are little prone to damage from the outside and, despite their embedding in metal have an effective field of radiation while retaining a good quality factor and sufficient selective reading distance. Such a chip transponder and associated antenna circuit can have, a selective distance of 20 through 30 cm.

However, a problem in these known chip transponders and associated potcore antenna circuits is the detuning of the frequency by the ferro metallic surroundings.

Summary of the invention.

The invention aims to obviate above mentioned problem and to provide a chip transponder with associated antenna or tank circuit of which the frequency is not detuned by the ferro-metallic surroundings.

This is achieved in the case of an antenna circuit of the above mentioned sort in that the potcore means are provided in the depression, except at the surface side, with a surrounding shield of a non-ferro metal.

In this implementation according to the invention surprisingly it appeared that a possible detuning of the antenna or tank circuit of the transponder, brought about by the shielding can be compensated by correcting the initial inductivity of the tank circuit. This can be effected such that, when the tank circuit is mounted mechanically fixed in the shield, the frequency can be again corrected to e.g. the usual frequency of 134,2 kHz. The advantage - once the transponder chip and antenna circuit are embedded in the thick-walled surface, it being ferro metal or non-ferro metal - is that the shielding prevents that the antenna or tank circuit is detuned or the quality factor Q is reduced.

A further advantage in this implementation is obtained because the shielding of non-ferro metal also offers mechanical robustness through which a possible plastic housing is not required anymore.

A further advantage is that the chip transponder and potcore antenna circuit can be mounted directly into a metal surface without the efficiency being aggravated.

Brief description of the drawings.

The invention will be illustrated in more detail by virtue of a few examples of various embodiments, with reference to the drawing, in which:

Figures 1a and 1b respectively present a transverse section view and a frontal view of a first embodiment in keeping with the invention; and

Figures 2a, 2b and 2c respectively present a transverse section view and a first and second frontal view of two variants of a second embodiment in keeping with the invention.

Detailed description of the invention.

In Figure 1a a transverse section view schematically is given of a built-in chip transponder and an associated antenna or tank circuit consisting of an open half potcore operating as antenna and a winding package in the cilindrical slot operating as antenna. In this transverse section the thick-walled surface is indicated with 1, the chip transponder built-in in the depression of the surface with 2, the half potcore of e.g. ferrite with 3, and the winding package with 4. The half potcore in this case consists of a bush implemented with bottom and hollow core, which bush at its upper side is open.

With such an arrangement of above chip transponder and potcore antenna, a detuning of the antenna comes about as a result of ferro-metallic material in the environment. By using a shield of non-ferro metal, such as e.g. a jacket of aluminum open at its upper side, the influence of the ferro-metallic environment can be obviated. Also other non-ferro metals, like copper, can be used for the shield. Advantageously the chip transponder is also inserted in the shielding jacket and is connected to the antenna or tank circuit in a non-indicated manner.

The possible detuning of the transponder antenna circuit brought about by the jacket 5 can surprisingly be compensated through correction of the initial inductivity of the antenna circuit. This can be arranged such that when the antenna circuit is mechanically mounted in the shielding jacket the transponder frequency is corrected to the usual frequency of 134,2 kHz. Also the shielding attends

to it that the quality factor upon mounting in a metal thick-walled surface as a whole is not reduced.

In this implementation of Figure 1 the edge of the cylindrical wall of the shielding jacket 5 is aligned with the surface and the upper side of the potcore antenna remains open bringing about a somewhat lower quality factor.

In Figure 2a a transverse section view is indicated again of an antenna circuit associated with a built-in chip transponder 2, which antenna circuit is similar to the one in figure 1. The shielding jacket 5 again is arranged around the cylindrical potcore such that the edge of the jacket 5 is flush with the upper surface of the wall 1. The dimensions of shielding jacket and potcore in this implementation are such that some room is maintained for a separate covering disc 6 of ferrite which is aligned with the said surface side. In this implementation a closed magnetic circuit is obtained with high quality factor.

In Figure 2b a front view is given in which the covering disc 6 is provided with a central hole in order to obtain a proper radiating or scattering field of the antenna. In Figure 2c a variant is given in which the covering disc 6 is provided with a slot extending on both sides of the center. Hereby the radiation field of the antenna is somewhat larger relative to the embodiment of Figure 2b while still maintaining a stable high quality factor. It is also possible to provide the covering disc with a second slot rectangular to the first slot.

It goes without saying that various modifications and alterations are possible within the framework of the invention. The antenna circuit can be implemented in an other manner, e.g. coupled with a resonator circuit on a half or whole potcore. In this case the antenna circuit is connected by means of one or more secondary windings to the windings of the potcore resonator.

Claims

1. An antenna circuit to be used in conjunction with a chip transponder to be built-in in a thick-walled surface, which antenna circuit is insertable into a depression in the surface destined for the chip transponder en serves both for the reception and emission respectively of interrogative signals for - and response signals from - the transponder, and in which the antenna circuit is formed by potcore means which have a radiation field extending in a direction away from the surface, **characterized** in that the potcore means are provided in the depression, except at the surface side, with a surrounding shield of a non-ferro metal.

2. Antenna circuit according to claim 1, in which the thick-walled surface is of metal.

3. Antenna circuit according to claim 1 and 2, in which the shield consists of an open shielding jacket with bottom and wall.

4. Antenna circuit according to claim 3, in which the potcore means comprises at least an open half potcore of ferrite having a winding package, and in which the wall of the shielding jacket, arranged around the potcore, extends to the surface side.

5. Antenna circuit according to claim 4, in which the potcore extends to the surface side and is open at said side.

6. Antenna circuit according to claim 4, in which the potcore extends to just under the surface side, and at said side is covered with a cover plate of ferrite having at least a center hole, which plate is aligned with the edge of the shielding jacket and the surface side.

7. Antenna circuit according to claim 6, in which the hole in the cover plate is implemented as a slot extending on both sides of the center.

8. Antenna circuit according to claim 1, in which the shielding is of aluminum.

9. Antenna circuit according claim 1, in which the chip transponder is arranged between the potcore means and the shielding.

10. Antenna circuit according to claim 4, in which the potcore means are coupled with a resonator circuit on a further half or whole potcore.

Fig-1a

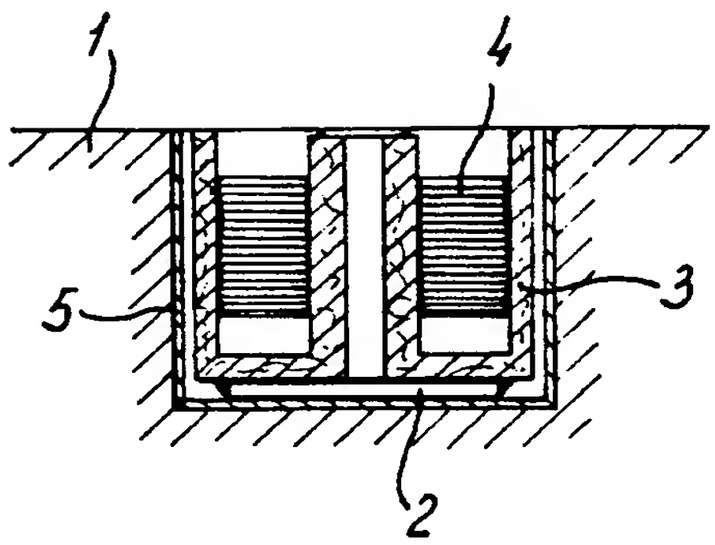


Fig-1b

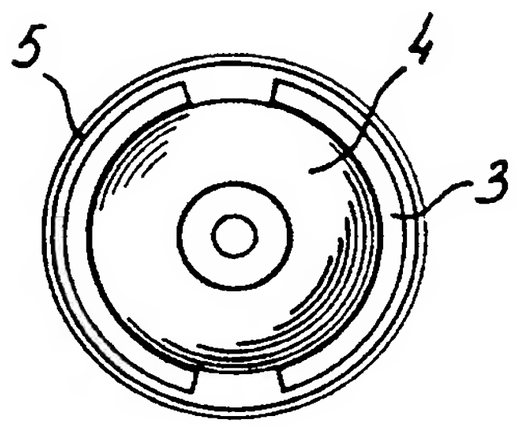


Fig-2a

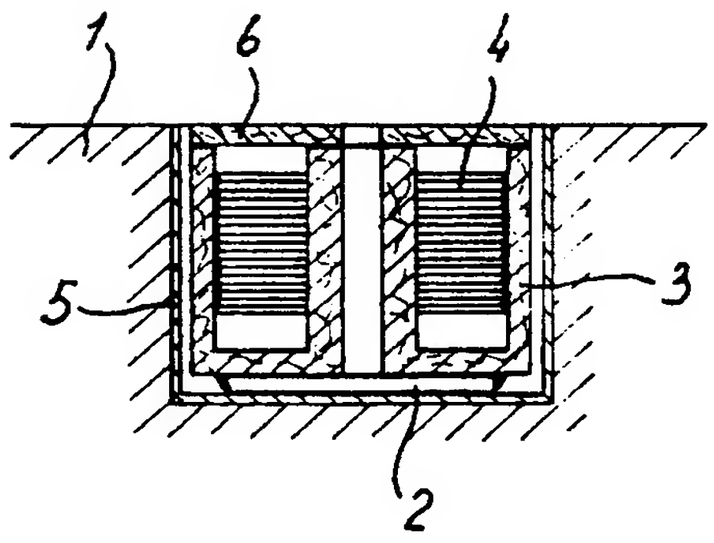


Fig-2b

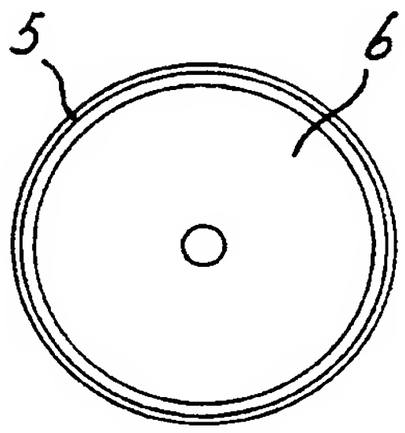
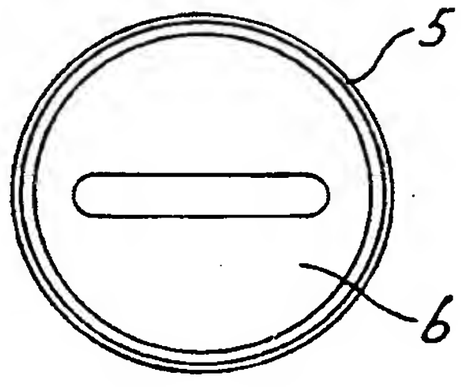


Fig-2c



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 20 1013

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	PATENT ABSTRACTS OF JAPAN vol. 9, no. 270 (E-353) (1993) 26 October 1985 & JP-A-60 116 111 (MATSUSHITA DENKI SANGYO) 22 June 1985 * abstract *	1,2	H01Q7/06
Y	EP-A-0 590 589 (TEXAS INSTRUMENTS) * column 2, line 26 - line 31; figure 1 *	1,2	
A	DE-C-10 52 592 (LICENTIA PATENT-VERWALTUNG) * column 1, line 1 - line 21; figures 1,2 * * column 2, line 43 - line 47 *		
A	DE-A-35 27 442 (PEPPERL & FUCHS) * column 2, line 57 - column 3, line 41; figure 3 * * column 5, line 17 - line 60 *		
A	EP-A-0 496 611 (TEXAS INSTRUMENTS) * column 3, line 29 - line 39; figure 3 *		TECHNICAL FIELDS SEARCHED (Int.Cl.6) H01Q H01F
A	EP-A-0 549 832 (TEXAS INSTRUMENTS) * the whole document *		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	7 September 1994	Breusing, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)